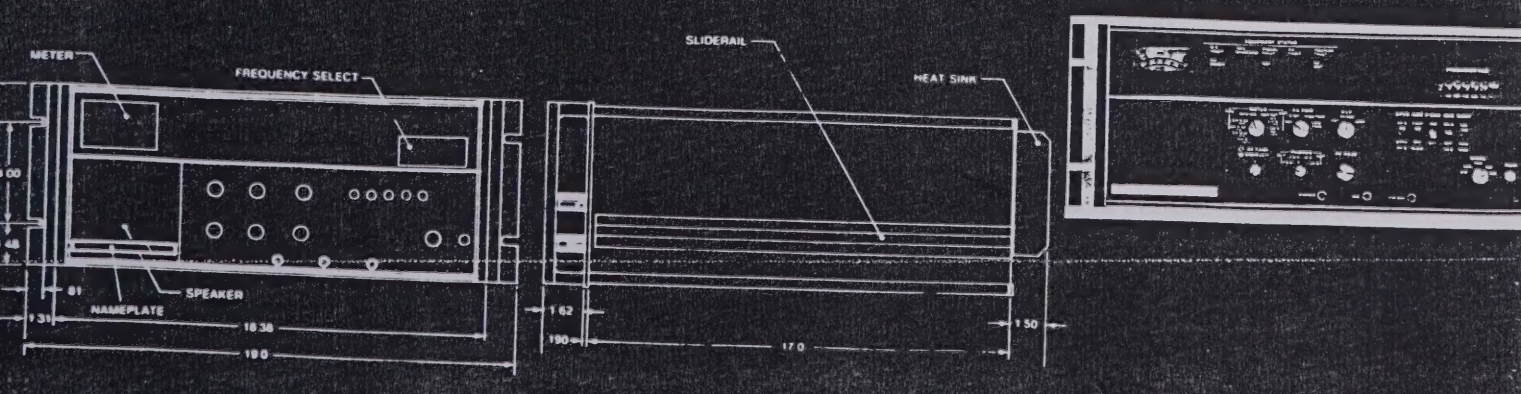
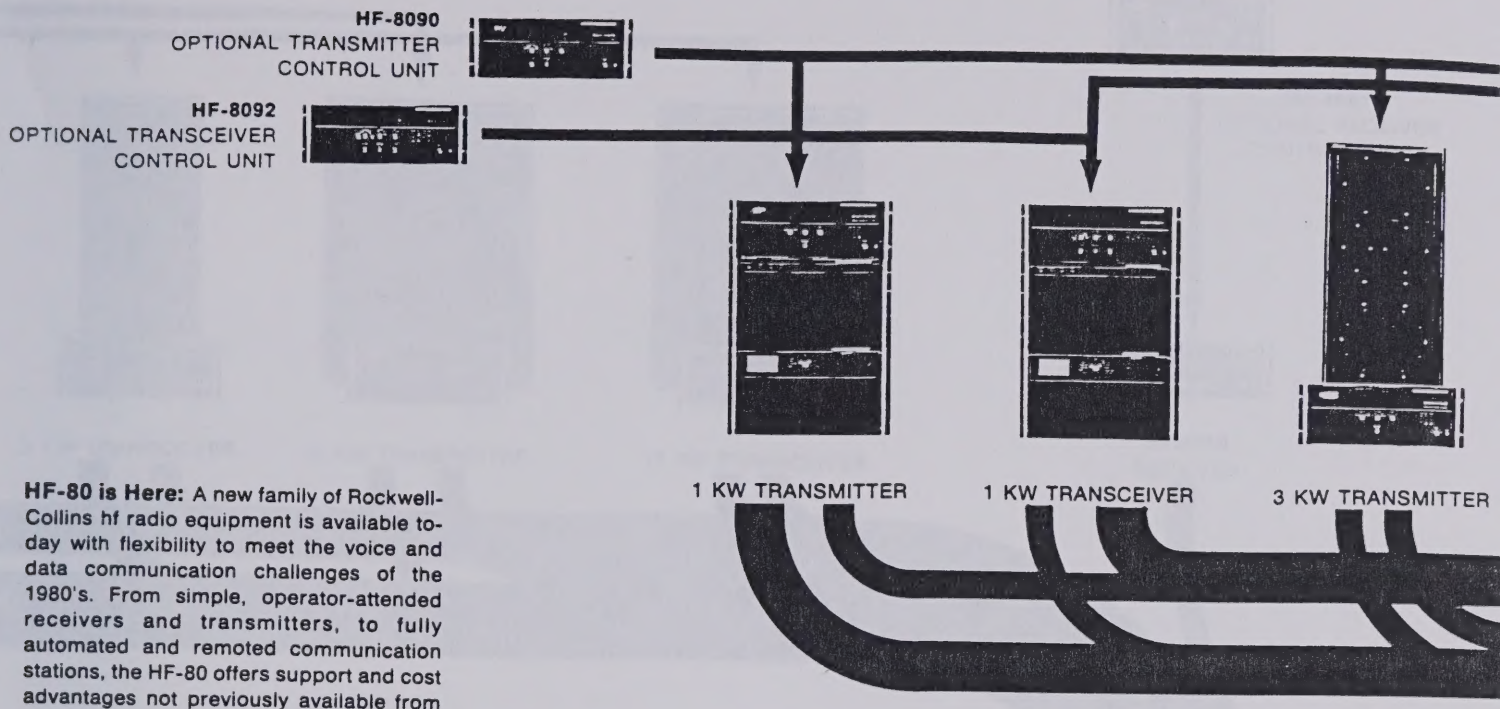
ett-80 sell data





meet the new family

HF-80 is Here: A new family of Rockwell-Collins hf radio equipment is available today with flexibility to meet the voice and data communication challenges of the 1980's. From simple, operator-attended receivers and transmitters, to fully automated and remoted communication stations, the HF-80 offers support and cost advantages not previously available from any other product line. Significant savings have been realized by application of the design-to-cost concept, together with Rockwell-Collins accumulated technology of over 40 years' experience in hf communications.

Cost-effectiveness and logistical benefits are obtained through a high degree of commonality among subassemblies and units, together with simple construction and reliable components. Maximum use is made of microelectronics and solid-state devices. Coupled with Rockwell-Collins traditional quality, this assures dependable service to keep the HF-80 in the station where it belongs...not in the maintenance shop where it is unproductive.

Flexibility is Economy: Adaptability of the HF-80 family makes a multisite, processor-controlled, remote system just as feasible as a single station manually controlled by one operator. The building block approach allows adding just those units necessary to get the system complexity desired. To go from a 3-kW, locally controlled station to a remotely controlled one, add a control unit and remote cards—it's as simple as that.

International specifications are to be met, not avoided, and Rockwell-Collins HF-80 family meets or exceeds all applicable requirements of ITU/CCIR. Full attention need be given only to the user's needs—the system will comply.

Modular flexibility used in the HF-80 allows commonality between the various units; and, ultimately, savings in acquisition and support costs to the user. Use of common modules reduces manufacturing costs as compared to production of completely different units. User costs are further reduced by the lower inventory and maintenance training expenses for a fewer number of different types of modules.

The same chassis used for the receiver is also used for the exciter, receiver/exciter, and control units with just those modules and front panel controls necessary for those functions. The frequency synthesizer, power supply, and other functional circuits common to the receiver and exciter are identical in each unit.

The innovative synthesizer design also employs common decade modules that facilitate expansion to 10-Hz or even 1-Hz tuning increments by simple module additions.

These and other benefits derived from the commonality approach make the HF-80 equipment the most cost-effective hf product line ever produced by Rockwell-Collins.

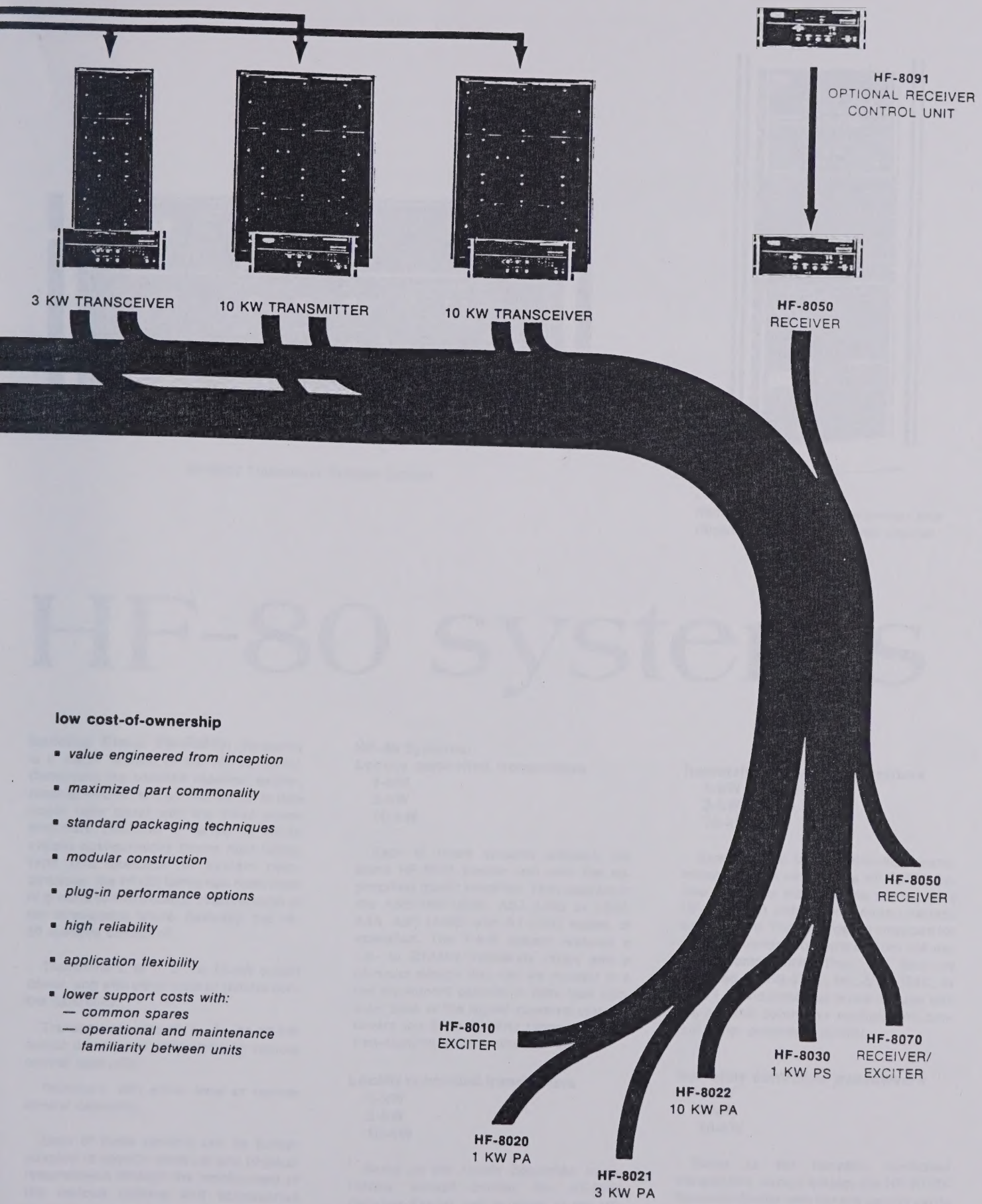
Growing Larger: From slide-in chassis-mounted circuit cards to slide-in rack-mounted units, expansion is carried out as needed, when needed. Select only the units needed, with confidence the system can be expanded as additional growth is desired.

Start with an HF-80 1-kW Transmitter and an HF-8050 Receiver and you have a basic communications station. As needs grow, change to a 3- or 10-kW transmitter—driven by the same exciter—(keep the 1-kW as a standby), maybe add a second receiver, then a receiver or exciter control unit, and you have a split-site, remotely controlled, high power communications station.

Because the Rockwell-Collins HF-80 family has been designed as a system, growth can be as simple as that described. User requirements no longer need be defeated by "no" answers to "Will it work together?" or "Can we afford all the added spares inventory?"

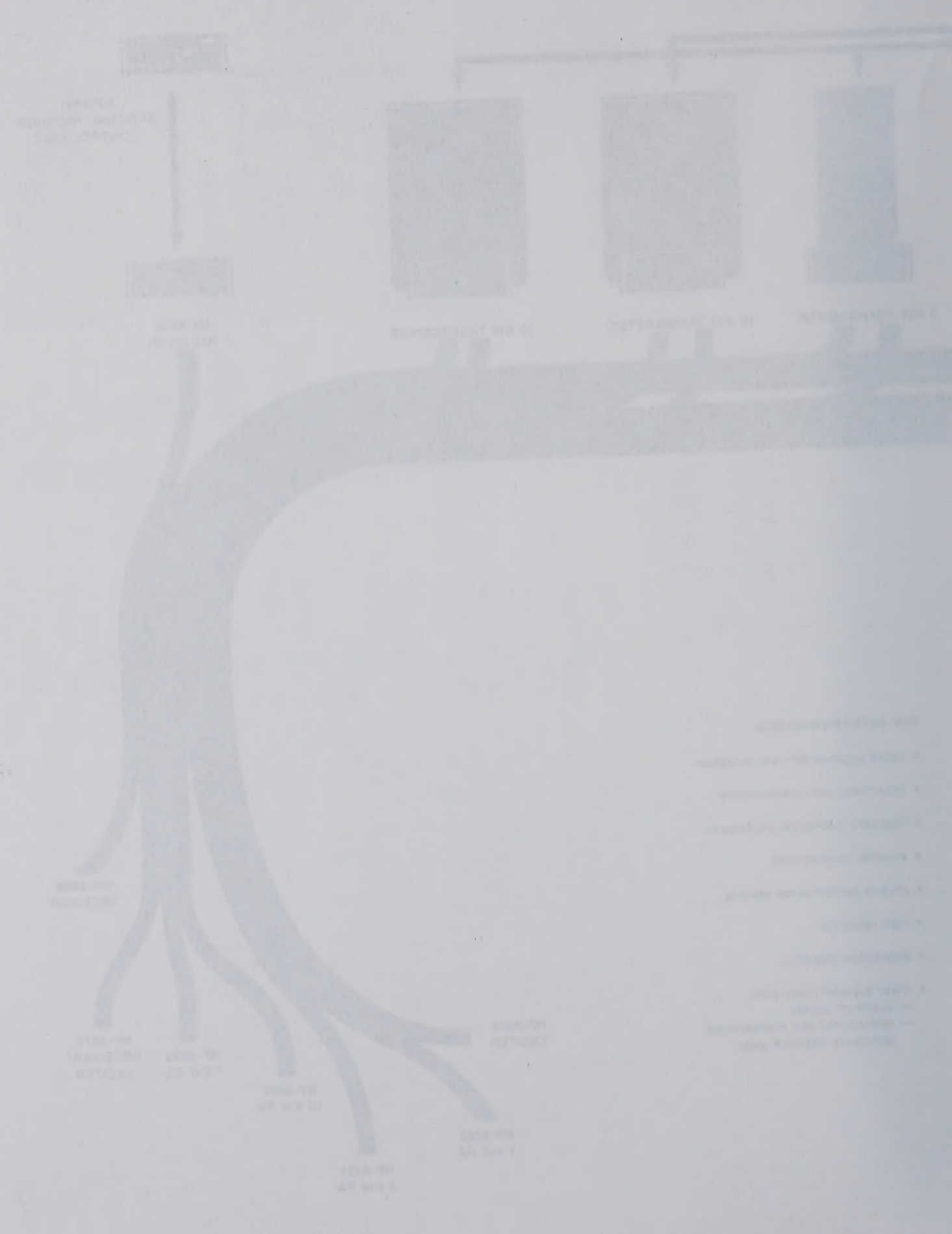
Of course, options other than add-on operational units are available. For example, selectable bandwidth filters are an optional module for the receiver. The 10-Hz tuning increment module is available in the exciter. And even a 1-Hz tuning increment module is available for processor controlled receiver or exciter applications where extra fine tuning is a requirement. Card extenders and easily accessible test points facilitate maintenance on all the units. Accessories and options are described in the back sections of the brochure.

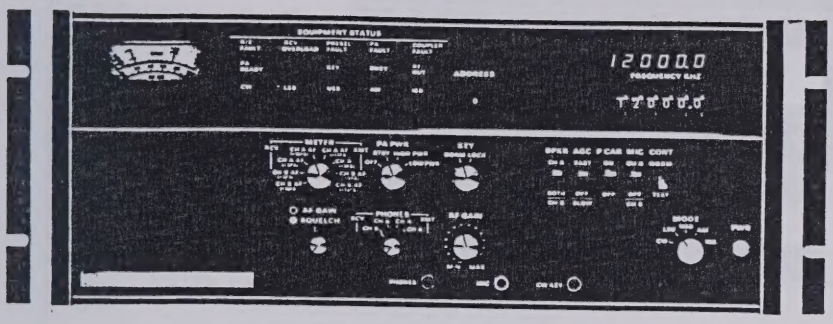
meet the new family



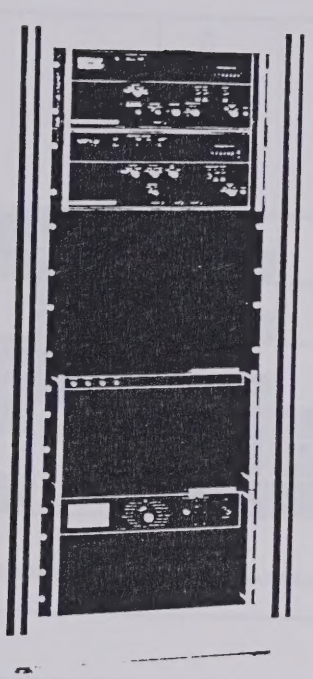
low cost-of-ownership

- *value engineered from inception*
- *maximized part commonality*
- *standard packaging techniques*
- *modular construction*
- *plug-in performance options*
- *high reliability*
- *application flexibility*
- *lower support costs with:*
  - *— common spares*
  - *— operational and maintenance familiarity between units*





HF-8092 Transceiver Remote Control



Remotely Controlled Transmitter and Receiver System in optional cabinet

HF-80 systems

Building Block Flexibility: Versatility is a major feature of the HF-80 family. Combining the baseline receiver, exciter, receiver-exciter, and control elements (see upper right table) with the three power amplifiers produces a variety of HF-80 system configurations (lower right table). With this selection of system combinations, the HF-80 family can meet most hf ground communication requirements of the foreseeable future. Basically, the HF-80 systems consist of:

Transmitters, of 1-, 3-, or 10-kW output power, and with either local or remote control capability.

Transceivers, also of 1-, 3-, or 10-kW output power, and either local or remote control capability.

Receivers, with either local or remote control capability.

Each of these systems can be further adapted to specific electrical and physical requirements through the employment of the various options and accessories described later in this document. With this flexibility, the HF-80 family is the product line that can most likely fill your specific requirement.

HF-80 Systems:

Locally controlled transmitters
- **1-kW**
- **3-kW**
- **10-kW**

Each of these systems employs the same HF-8010 Exciter unit with the appropriate power amplifier. They operate in the A3B/A9B (ISB), A3J (USB or LSB), A3A, A3H (AME) and A1 (CW) modes of operation. The 1-kW system features a 1.6- to 30-MHz frequency range and a compact design that can be housed in a low equipment cabinet or desk type console. Each of the higher powered systems covers the 2- to 30-MHz range and uses free-standing power amplifier units.

Locally controlled transceivers
- **1-kW**
- **3-kW**
- **10-kW**

Same as the locally controlled transmitters, except employ the HF-8070 Receiver-Exciter unit in place of the HF-8010 Exciter.

Remotely controlled transmitters
- **1-kW**
- **3-kW**
- **10-kW**

Same as the locally controlled transmitters, except employ the HF-8010A Exciter unit. This exciter is the same as the HF-8010, but with three remote interface cards added. These cards are strapped for an FSK interface for control from the optional control unit. They can also be strapped for RS-232C, MIL-STD-188C, or CCITT v.24 compatible levels for use with the optional control for multiple unit control or for processor control.

Remotely controlled transceivers
- **1-kW**
- **3-kW**
- **10-kW**

Same as the remotely controlled transmitters, except employ the HF-8070A Receiver-Exciter with remote control cards in place of the HF-8010A Exciter.

Receiver, Exciter, Receiver-Exciter, Controls Baseline Configuration

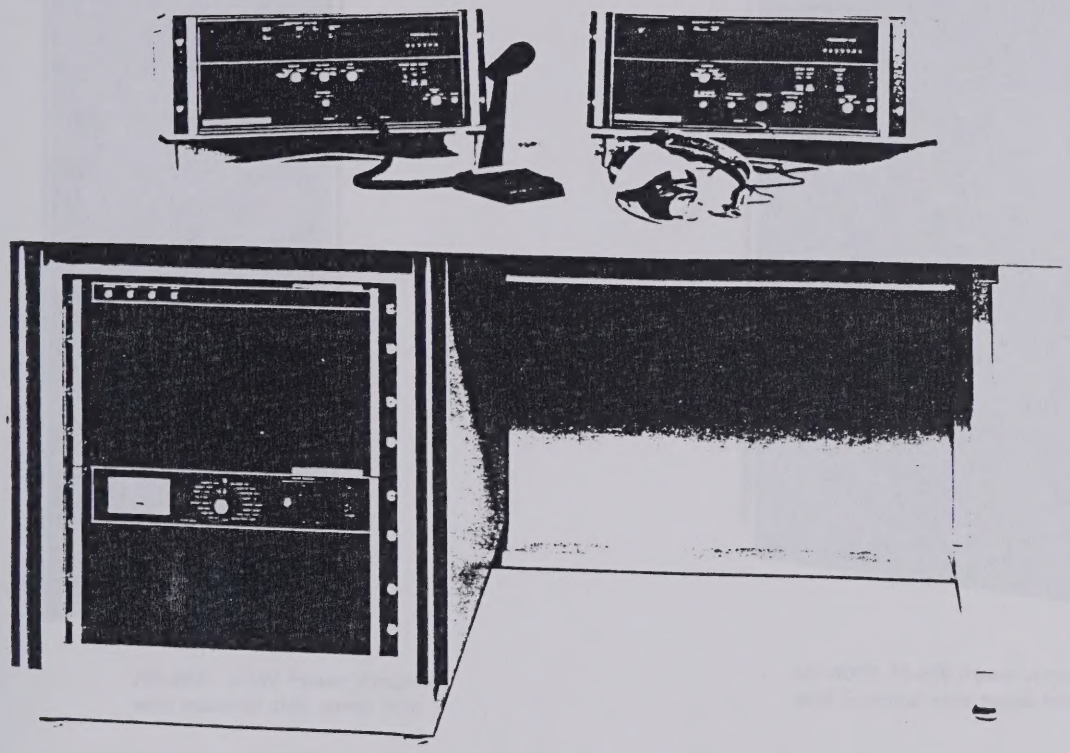
	10-HZ DIGIT	100-HZ DIGIT	ISB (2.7-kHz USB/ 2.7-kHz LSB)	SQUELCH	LOCAL/REMOTE SWITCH	SPEAKER	REMOTE CONNECTOR	REMOTE CONTROL MODULES	FULL READBACK OF PARAMETERS
HF-8050 RECEIVER (L) HF-8050A RECEIVER (L/R)	■	■	■	■	■	■	■		
HF-8010 EXCITER (L) HF-8010A EXCITER (L/R)		■			■		■		
HF-8070 REC-EXC (L) HF-8070A REC-EXC (L/R)		■	■	■	■	■	■		
HF-8091 REC CONTROL HF-8090 EXC CONTROL HF-8092 REC-EXC CONTROL	■	■	■					■	■

NOTES: (L) — LOCAL CONTROL
(L/R) — LOCAL/REMOTE CONTROL
ALL REMOTE CONTROL MODULES HAVE FSK, RS-232 OR MIL-STD-188, OR CCITT v.24 CAPABILITY THROUGH STRAPPING.
STANDARD RECEIVER BANDWIDTHS ARE 2.7 kHz USB/LSB AND 16 kHz AM.

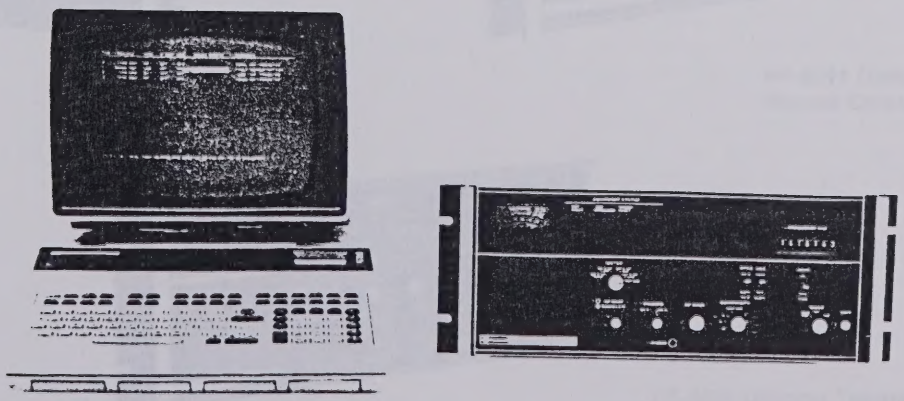
HF-80 System Configurations

HF-80 SYSTEM \ HF-80 EQUIP	HF-8010 EXCITER (L) 622-3389-001	HF-8010A EXCITER (L/R) 622-3395-001	HF-8070 REC-EXC (L) 622-3387-001	HF-8070A REC-EXC (L/R) 622-3394-001	HF-8020 1 KW PA 622-3380-001	HF-8030 1 KW PS 622-3383-001	HF-8021 3 KW PA 622-3381-001	HF-8022 10 KW PA 622-3382-001		Optional Controls: HF-8090 Tx CONTROL 622-3390-001	Optional Controls: HF-8092 Tx-Rx CONT 622-3392-001
1 KW Tx (L)	■				■	■					
1 KW Tx (L/R)		■			■	■				■	
1 KW Tx-Rx (L)			■		■	■					
1 KW Tx-Rx (L/R)				■	■	■					■
3 KW Tx (L)	■						■				
3 KW Tx (L/R)		■					■			■	
3 KW Tx-Rx (L)			■				■				
3 KW Tx-Rx (L/R)				■			■				■
10 KW Tx (L)	■							■			
10 KW Tx (L/R)		■						■		■	
10 KW Tx-Rx (L)			■					■			
10 KW Tx-Rx (L/R)				■				■			■
RECEIVER EQUIPMENT HF-8050 Rx (L) 622-3385-001 HF-8050A Rx (L/R) 622-3393-001 HF-8091 Rx Control 622-3391-001											

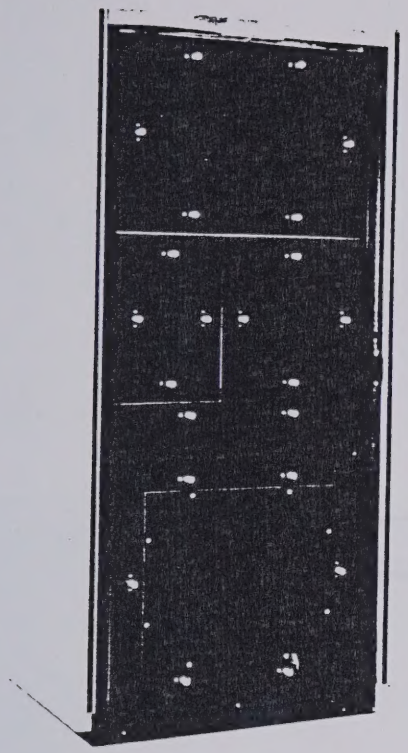
NOTE: (L) LOCAL CONTROL (R) REMOTE CONTROL Rx — RECEIVER Tx — TRANSMITTER Tx-Rx — TRANSCEIVER



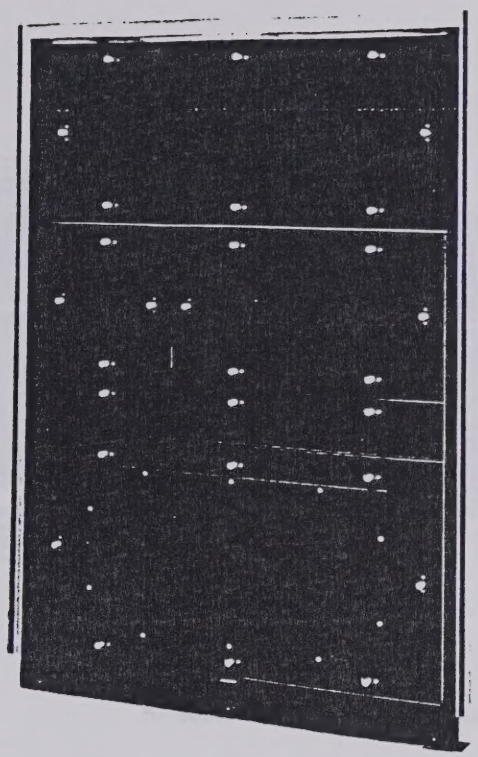
Locally Controlled 1-kW Transmitter and HF-8050 Locally Controlled Receiver with optional cabinets



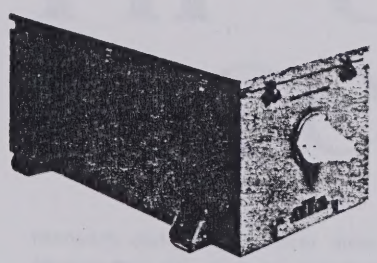
Computer-Controlled Receiver



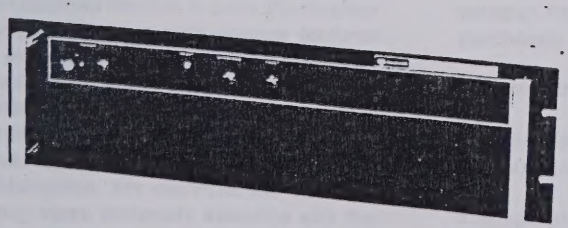
HF-8021 3-kW Power Amplifier with optional side panel trim



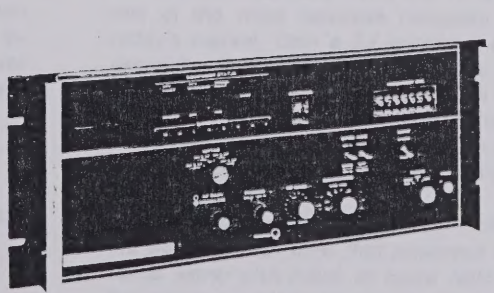
HF-8022 10-kW Power Amplifier with optional side panel trim



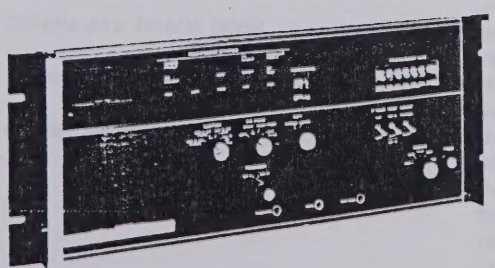
HF-8040 Antenna Coupler for use with 1-kW system when VSWR exceeds 3 to 1



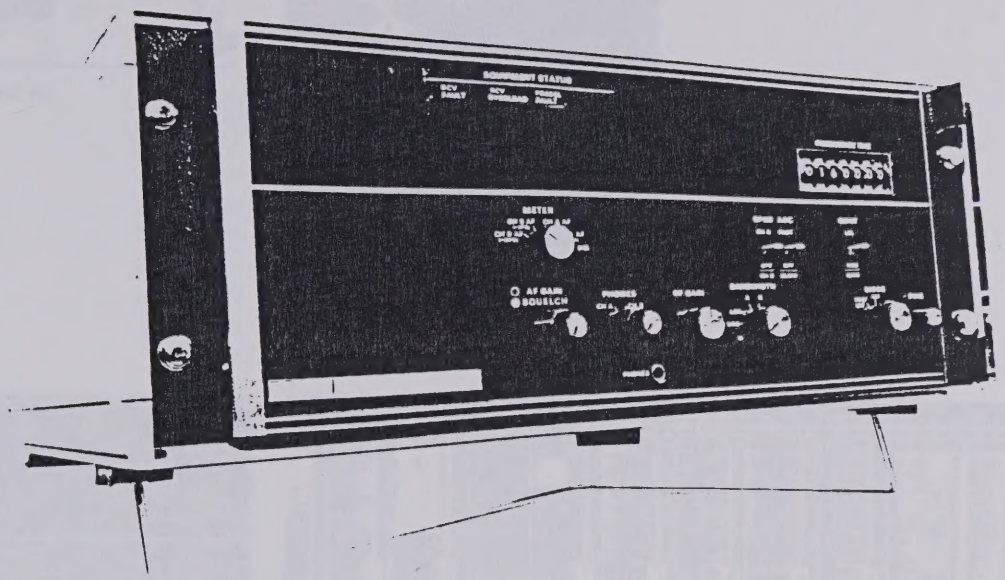
HF-8060 Preselector can be used with the HF-8010, HF-8050, or the HF-8070



HF-8091 Optional Receiver Remote Control



HF-8090 Optional Transmitter Remote Control



HF-8050A Receiver in optional cabinet

HF-8050 receiver

The User's Receiver: From installation and operation to maintenance, the HF-8050 Receiver is user-oriented. System interconnections are made easily through rear connectors and terminal strips. Only those controls needed to pace the receiver through its superb performance features are presented to the operator. Slide-out chassis and plug-in circuit cards give almost instant access for those few times maintenance may be needed.

Outside simplicity hides operational sophistication. For example, the 1-Hz frequency steps optionally available with the advanced-design synthesizer circuit; or the commonality between the receiver and exciter with just 4 different modules and different front panel. Conversion from manual to FSK or processor remote control is done by a simple 3-card addition. Growth in sophistication is at the user's command, not an operational constraint with the HF-8050 Receiver.

In its basic configuration the HF-8050 receiver operates in ISB, LSB, USB, CW and AM modes up to 29.99999 MHz. Although the lower frequency sensitivity is specified to 250 kHz, the HF-8050 makes an excellent mf receiver for lower frequencies with some degradation of sensitivity. The HF-8050 makes an excellent manually controlled receiver either for a receive-only site, or a full communication station. User-installed circuit cards expand the performance features and increase the versatility of the receiver without the added cost of a newly purchased, or different type, unit.

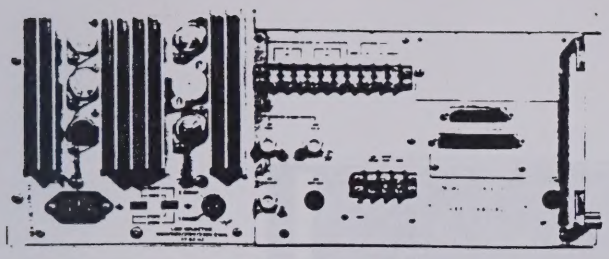
receiver baseline

- *A3B/A9B (ISB), A3J (USB or LSB), A3/ (AM) and A1 (CW)*
- *temperature-compensated crystal oscillator*
- *10-Hz tuning increments*
- *2.7-kHz and 16-kHz filters*
- *19-inch EIA rack mount*
- *manual frequency selection*

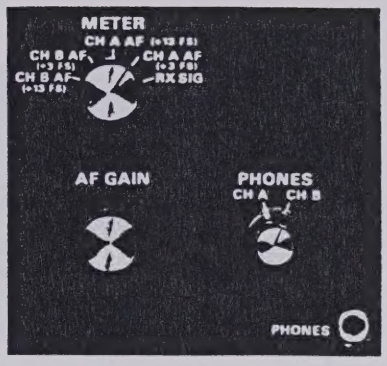
Sensitivity: Low-noise components used in the rf input circuits make the HF-8050 one of the most sensitive receivers on today's market. Only a 0.7-microvolt emf signal (hard) is required to produce a 10-dB signal-plus-noise to noise ratio in the HF-8050. This is equivalent to 0.35 "soft" microvolts, quoted more frequently in the electronics industry for sensitivity measurements.

The "hard" microvolt measurement is the signal voltage level that produces the 10-dB signal-plus-noise to noise ratio in the receiver, measured across the open circuit terminals of a signal generator having a 50-ohm output impedance. "Soft" microvolt measurement is the signal voltage that produces the same 10-dB signal-plus-noise to noise ratio in the receiver, but measured across the input terminals of the receiver with the signal generator connected. Thus, if the signal generator has a 50-ohm output impedance and the receiver has a 50-ohm input impedance, the voltage level measured with the signal generator connected to the receiver (soft) will be one-half that measured across the signal generator open circuit (hard).

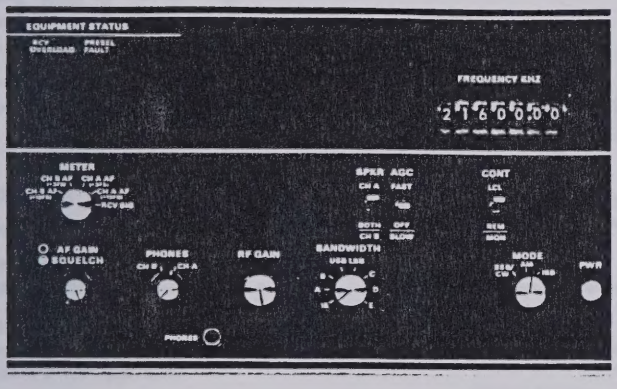
HF-8050 Receiver



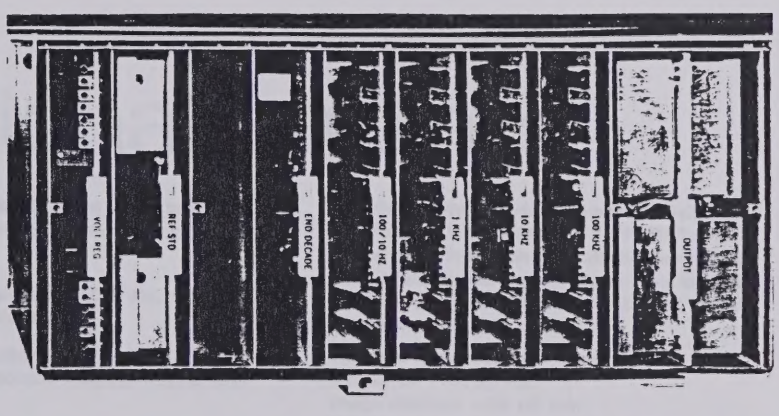
Receiver rear connections designed for simplicity



Full audio monitoring and control provided



Control layout engineered for operator convenience



New decade synthesizer allows expansion to 1-Hz increments

Performance Counts! Signal regulatory work demands instantaneous response. The 5-millisecond maximum channeling time, typical of the processor-controlled receivers, gives the high-speed frequency changes needed in search operations.

Stability as well as speed is the word in the frequency synthesizer, common to the receiver and the exciter. Normal stability in the master oscillator is 5 parts in 10^7—that's 15-Hz variation in 30 MHz! Provisions for a higher stability oven-type oscillator and an external frequency standard are available if more demanding stability is needed.

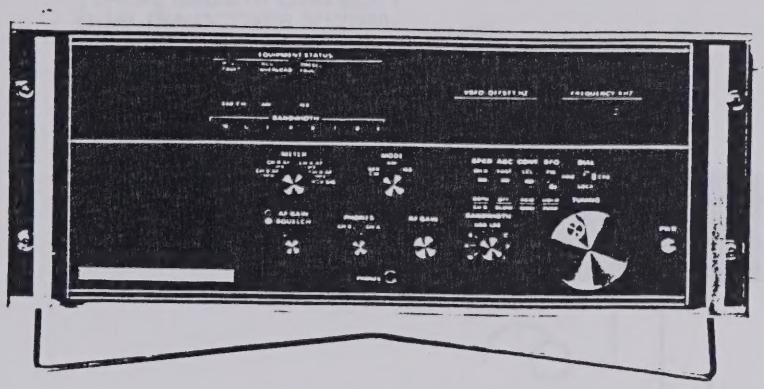
Applications, Simple or Complex: Whether as a desk-top, general coverage, manually controlled hf receiver, or one of a series of processor controlled receivers in a frequency scanning network, the HF-8050 will meet almost every application need. Versatility, offered through the available options, lets the user configure the receiver to satisfy individual system requirements.

In-station use is not an operational restriction on the HF-8050. By adding an HF-8091 Control Unit, the receiver can be located at the antenna site and controlled from the communications station. All input/output signals (except rf input and if outputs), including control/monitor readback, are available at the control unit. Control lines can be connected over field wire, telephone lines, or radio link with the FSK interface. Using the RS-232C, MIL-STD-188C or CCITT v.24, strapping on the same interface card allows data-quality cable lines to be used for processor-controlled systems.

A processor-controlled search and monitor system is a typical example of a complex, fully automated receiver system. Through available options, such a system can: control up to 16 receivers per control bus; automatically and continuously search hundreds of predetermined frequencies within the hf band; observe each frequency; and assign receivers to monitor traffic on the active channels. Entire system operation is under control of the processor. The optional HF-8050 1-Hz channel incrementing, usable in processor controlled receivers, facilitates fine-frequency selection in search and monitor operations. Changing operational parameters to match changing conditions, such as propagation conditions, is as simple as programming the desired frequency, mode, and bandwidth into the processor.

The HF-80 family's building block design approach is not limited to the individual units; the design concept is carried through on the system level. The user has no difficulty in expanding either the unit or the system to fit application needs.

851S-1: The 851S-1 Receiver is based on the HF-8050 design but features dial-like tuning instead of thumbwheel switches. This makes it easier for an operator to find the desired transmission if he lacks prior knowledge of the exact frequency. Independent sideband (ISB) operation is optional for the 851S-1 receiver. A matching remote control unit (HF-8095) is available for the 851S-1.



851S-1
Receiver in optional cabinet

Receiver Characteristics

Electrical

Frequency coverage: Up to 29.99999 MHz. Low end sensitivity specified at 250 kHz.

Frequency stability: Not less than 5×10^{-7} over specified temperature. Drift rate of not more than 3×10^{-8} per week.

Optional oven standard provides not less than 1×10^{-8} over specified temperature.

External standard option provides stability of the 100-kHz, 1-MHz, or 5-MHz external standard used.

Tune increments: 10 Hz with optional expansion to 1 Hz for processor control applications.

Channeling speed: 2 ms nom; 5 ms, max.

Sensitivity (SSB): 0.25 to 1.6 MHz, 2 μV "hard" (1.0 μV "soft") for 10 dB s+n/n; 1.6 to 29.9 MHz, 0.7 μV "hard" (0.35 μV "soft") for 10 dB s+n/n.

(AM, 30% modulated): 0.25 to 1.6 MHz, 16.5 μV "hard" (8.3 μV "soft") for 10 dB s+n/n; 1.6 to 29.9 MHz, 5.7 μV "hard" (2.85 μV "soft") for 10 dB s+n/n.

Modes of operation: A3B/A9B (ISB), A3J (USB or LSB), A3 (AM), and A1 (CW).

Bandwidths: 16-kHz, 2.7-kHz USB, and 2.7-kHz LSB. Space provided for five additional filters.

Digital VBFO (optional): Tunes ±9.99 kHz in 10-Hz steps. Phase-locked to the frequency standard.

Antenna input impedance: 50 ohms, nom; unbalanced (1.5:1, max vswr).

Rf overload protection: Up to 100-V rf input, power on or off. Automatic reset upon removal of strong signal.

Audio outputs

Line: 600 ohms ±10%, bal; 0 dBm, nom; adj, -20 to +10 dBm.
Headphone: 600 ohms, nom; +10 dBm, min.
Speaker: 8 ohms, nom; 2 watts, min.

Squelch: Operates on audio signal-to-noise ratio. Applicable only to speaker output.

If output: 20 mV at 450 kHz into 50 ohms for 3-μV input signal.

Audio hum and noise: -40 dB on line audio output.

Gain: 0 dBm line audio out for 3 μV input, SSB mode.

AGC threshold: 3 μV max.

AGC control: 4-dB max rise in audio out for signal increase from 3 μV to 0.3 V.

AGC time constants: 5 ms nominal, attack. 0.1 s fast decay and 1 s slow decay.

Intermodulation distortion: In band, -40 dB from either of two input tones, 0.1 V per tone.
Out of band, 2nd order is 70 dB below and 3rd order is 80 dB below either of two input signals, -25 dBm per tone, 50 kHz or more off center frequency.

Spurious responses to external signals:
If rejection -100 dB min.
Image rejection -100 dB min.
Other spurious -80 dB min at 20 kHz or more off center frequency.

Primary power: 100/115/215/230 V ac ±10%, single phase, 47-63 Hz; 80 watts, max.

Physical

Size: 483 mm wide x 178 mm high x 483 mm deep (19 in w x 7 in h x 19 in d), nominal.

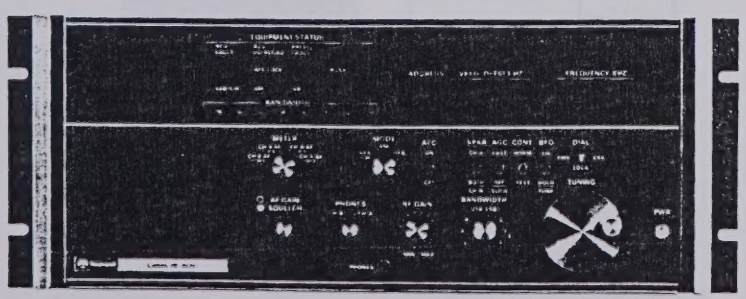
Mounting: EIA 483-mm (19-in) equipment rack, or optional case.

Weight: 15.8 kg (34 lb) max.

Weight: 19.0 kg (42 lb), nominal.

Environmental: 0 to 50 °C (+32 to +122 °F), full performance; -20 to 0 °C (-4 to +32 °F), reduced performance; -57 to +70 °C (-71 to +158 °F), nonoperating; 0 to 95% relative humidity; up to 3,048 m (10,000 ft) for the full temperature range, and 4,572 m (15,000 ft) for 25 °C or less, operating, up to 12,190 m (40,000 ft), nonoperating.

Specifications subject to change without notice.



HF-8095

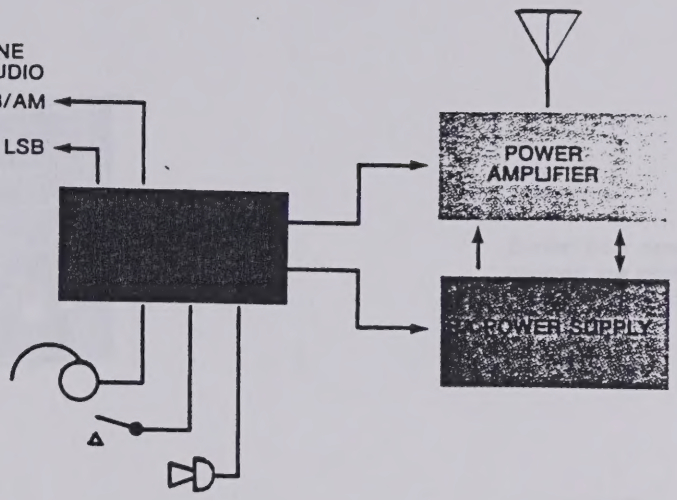
HF-8095 Control, Receiver (Collins PN 622-3386-001)

The HF-8095 Control, Receiver permits complete frequency, mode, bandwidth, rf gain, AGC, and ISB audio channel remote control of up to 16 851S-1 Receivers. Monitor information (frequency, mode, bandwidth, fault summary) is provided and displayed on the control front panel. Control is by 2-wire, voice grade communication line with unlimited distances, depending on line characteristics. Control is complete with FSK modem, ready for connection to communication line for single receiver control. Control output can also be strapped for EIA RS-232C (CCITT V.24) or MIL-STD-188C data characteristics for use with external modems (and processors) to control multiple receivers.

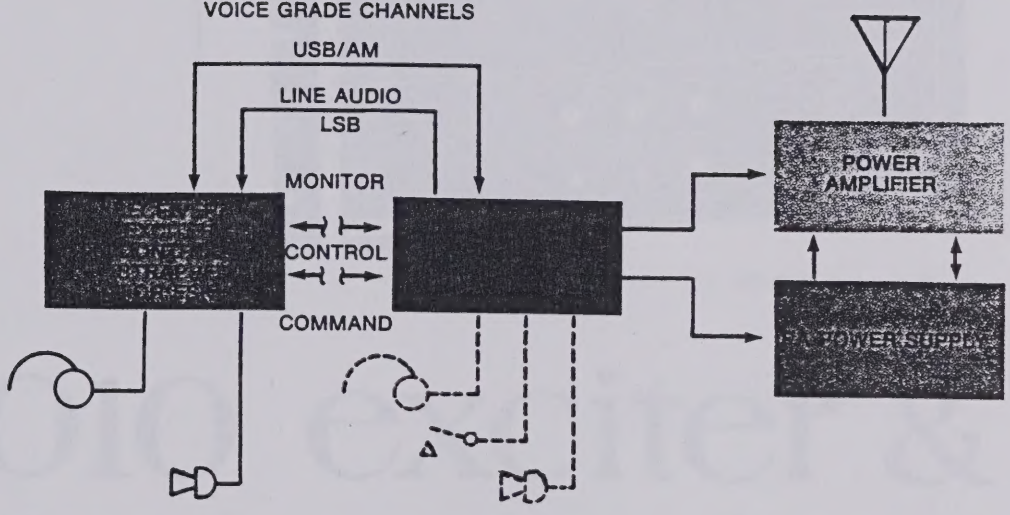
8515-1
Receiver in optional cabinet

TYPICAL GROWTH CAPABILITY
(1-kW TRANSCEIVER SHOWN)

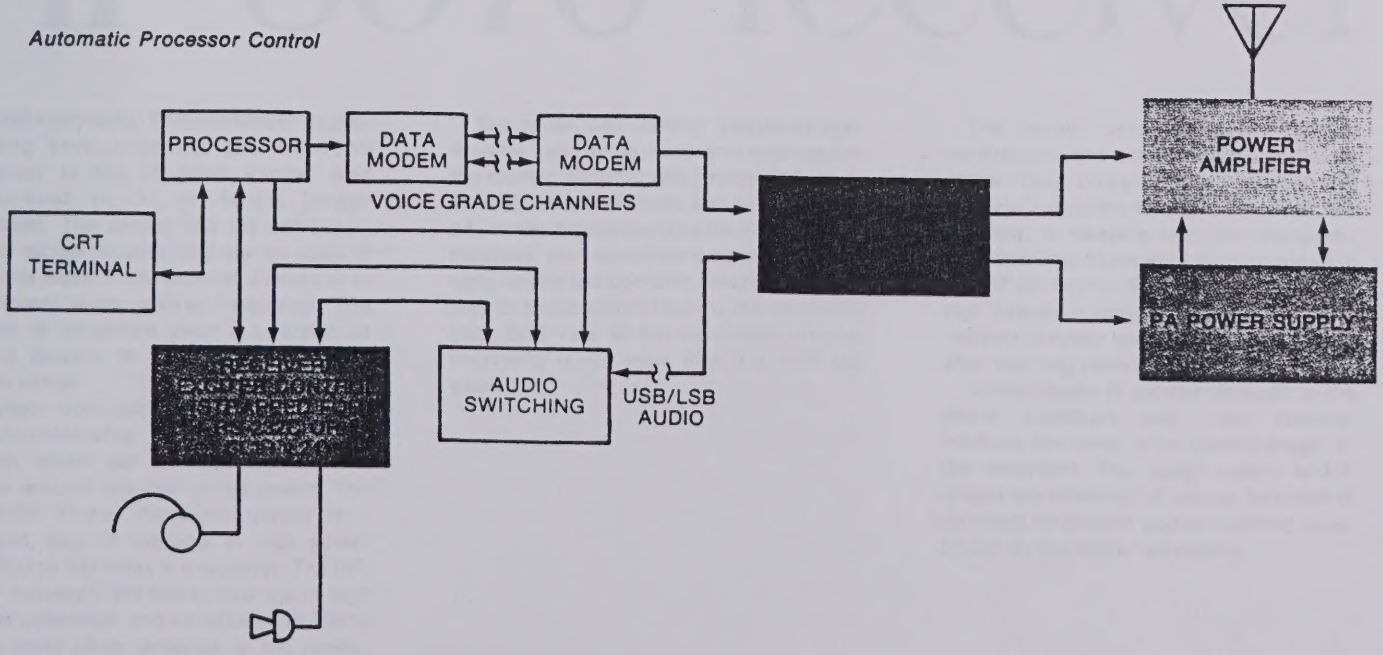
Manual Control

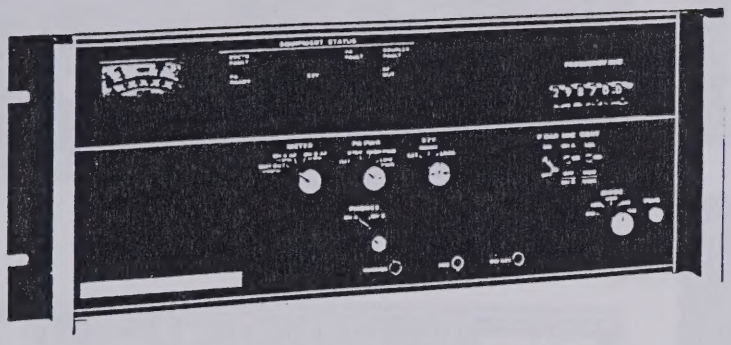


Remote Control



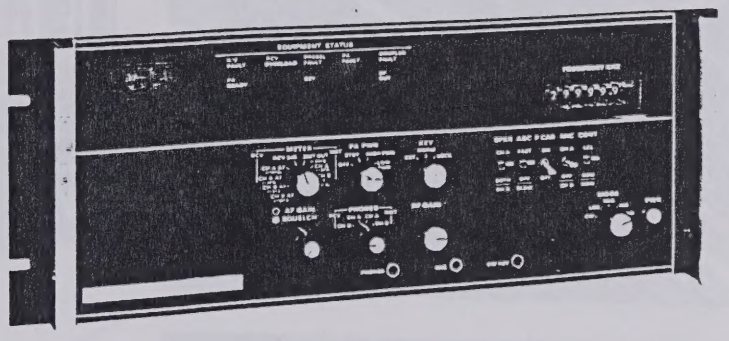
Automatic Processor Control





HF-8010 Exciter

Exciter front panel controls are similar to the receiver for operat advantage



HF-8070 Receiver/Exciter

HF-8010 exciter & HF-8070 receiver /

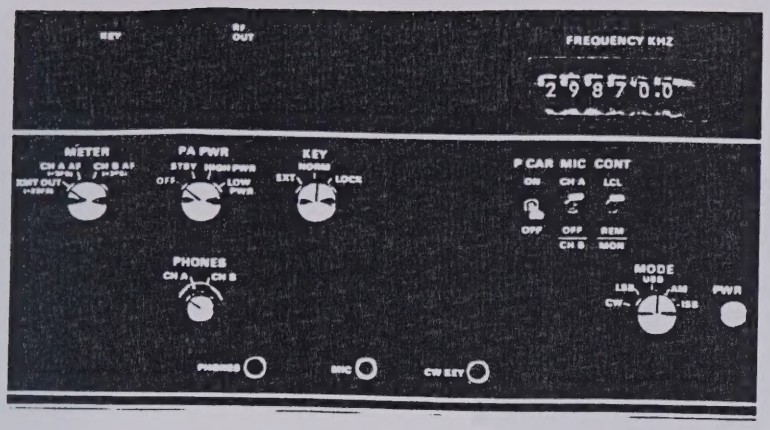
Complementing Transmitters: Transmitting companion to the HF-8050 Receiver is the HF-8010 Exciter and associated 1-, 3-, or 10-kW Power Amplifier. The exciter has the same versatility as the receiver and can be used to transmit either in the receiver's mode or in a different mode and/or frequency. The choice of amplifiers gives a selection of output powers to obtain the necessary signal range.

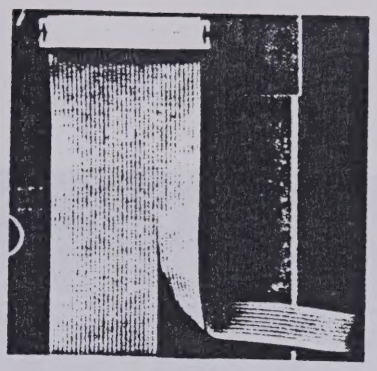
Output from each of the amplifiers is switch-selectable between full or low power, which can be adjusted within a range around one-half of full power. The HF-8020 Power Amplifier output is 1 kilowatt, pep or average, in high power and 300 to 700 watts in low power. The HF-8021 delivers 3-kW pep or average in high power operation and an adjustable 700 to 2000 watts when switched to low power. The HF-8022 will deliver a full 10-kW pep or average or, when switched to low power, an adjustable 3- to 7-kW output.

The same high-stability frequency synthesizer used in the receiver is also used in the exciter. Whether the optional 10- or 1-Hz frequency increment module is installed, or the frequency is set in normal 100-Hz steps, the transmitter output will be exactly where the operator selects—no drifting to cause signal loss on the reception end. Drift rate of the ultrastable exciter frequency is not more than 3×10^{-8} per week.

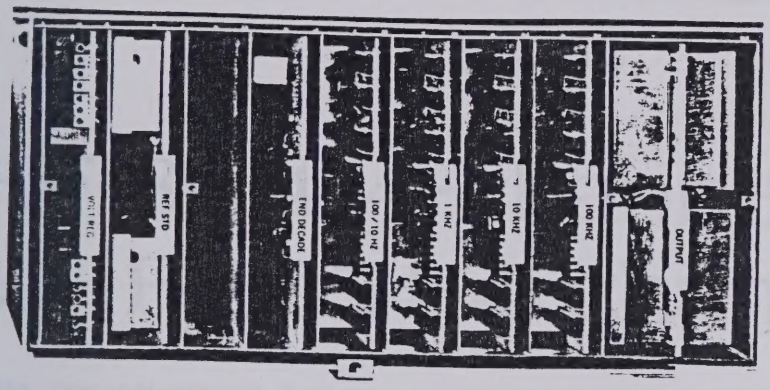
The exciter uses the same chassis, synthesizer, and power supply as the receiver. Only those plug-in modules and controls necessary to make an exciter are different, in keeping with the design-to-cost, building-block approach common in the HF-80 family. Similar front panel design makes it easier for the operator to become familiar with the exciter controls after learning receiver operation.

Commonality is carried through in the power amplifiers also. Four identical modules are used in the control stages of the amplifiers. The power supply and rf stages are different, of course, because of the need for greater power handling capabilities in the larger amplifiers.

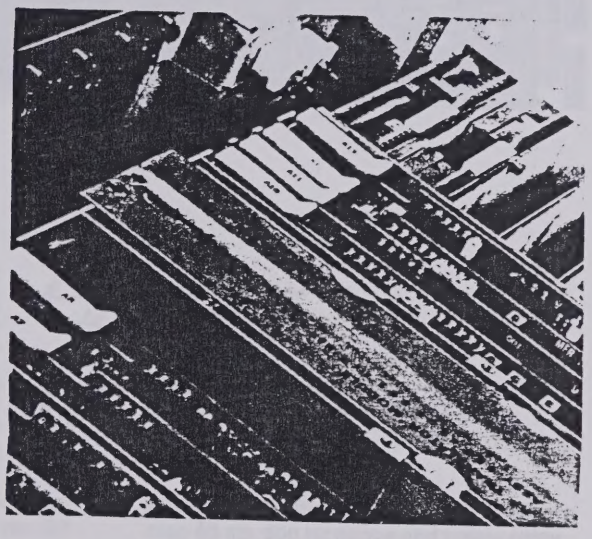




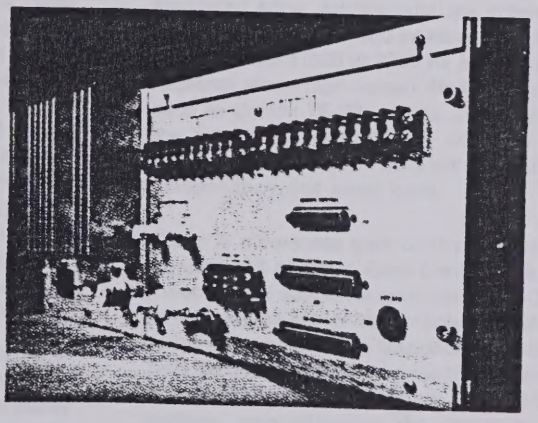
Ribbon wiring reduces costs



100-Hz standard synthesizer has growth capability to 10-Hz (shown) or even 1-Hz steps



Test points and plug-in cards enhance maintainability



Simple interconnects minimize system installation time

exciter

Baseline configuration of the exciter is frequency coverage from 1.6000 through 29.9999 MHz in the A3B/A9B (ISB), A3A, A3J (SSB), A3H (AME), and A1 (CW) emission modes. Just as the receiver can be optionally processor-controlled to switch modes and frequencies, so can the exciter. In fact, the same three plug-in modules providing the processor/receiver remote control interface are also used in the exciter.

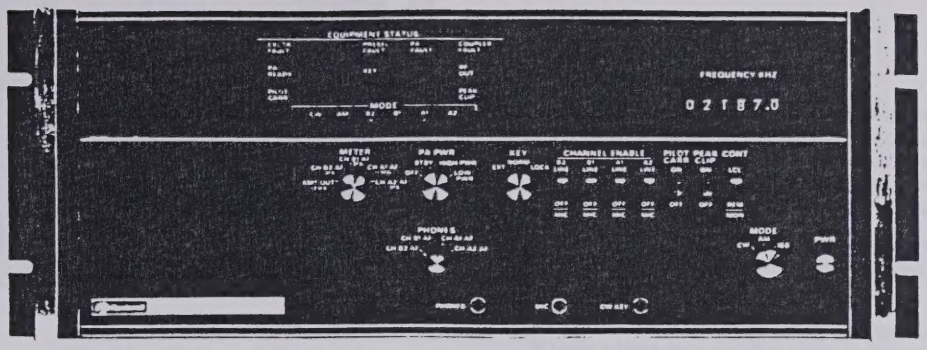
If remote control by processor is not desired, manual control units for the receiver and exciter are optionally available. This permits the receiver and exciter units to be located at the power amplifier/antenna site or split sites while the operator maintains total control over the station from the remote console. Control units maintain the same front-panel arrangement as their receiver and exciter counterparts—another cost savings to the user through reduced operator training and familiarization.

The Transceiver Configuration: The HF-8070 Receiver/Exciter makes an ideal transceiver unit in systems not requiring separate receivers and exciters. Since common circuit functions are shared by single circuits in the receiver/exciter, duplicate circuits are unnecessary. This does not eliminate the same versatility through options that the receiver and exciter have individually. It does, however, give lower equipment and support costs than separate units.

The HF-8070 offers the same high performance characteristics as a combination of the receiver and exciter units. Transmission and reception must be in the same emission mode and frequency, however—not an operational limitation in many system uses.

As with individual units, the receiver/exciter can be remote controlled either manually or by processor. A combined receiver/exciter control unit serves this purpose with the same advantages as the individual control units—operational familiarity, versatility of system use, and convenience of equipment location.

Each of these six units (receiver, exciter, receiver/exciter, and their remote controls) occupies 178 mm (7 in) of panel space in a standard 483-mm (19-in) EIA equipment rack and all have similar front panel layouts. Where desired, these units can be housed in optional cases suitable for desk-top use.



HF-8014 Exciter

HF-8014 4-channel exciter & HF-8054 4-channel receiver

Collins Telecommunications Products Division is proud to add 4-channel receiver and exciter units to the HF-80 family. A radio system using the new HF-8054/54A receiver and HF-8014/14A exciter has four independent, 2.85-kHz channels for any combination of voice, multiplexed telegraph, or high-speed data communication. These new units are completely compatible with the HF-8060 preselector, HF-8040 antenna coupler, and all HF-80 power amplifiers. For remote control, an HF-8093 exciter control and HF-8094 receiver control unit can command and monitor up to sixteen respective HF-8014A exciters or HF-8054A receiver units.

The HF-80 low cost-of-ownership philosophy is maintained for all four new units. Nearly all the radio circuits are mounted on plug-in modules with test jacks generously provided for easy maintenance. Wherever possible, identical modules are used in the receivers, exciters, and controls to minimize spare parts inventory. Both the HF-8014/14A and HF-8054/54A can initially be ordered outfitted for only two channels and thus allow the owner the option of expanding to four channels in the future by simply adding plug-in modules.

HF-8014/14A 4-Channel Exciter

The HF-8014/14A exciter can be combined with any HF-80 series power amplifier, including the new solid-state HF-8023, to form a 1-, 3-, or 10-kW transmitter. The major innovation of the HF-8014/14A is, of course, its four channels. The sidebands are designated A1, A2, B1, and B2. A1 and B1 channels correspond to the conventional upper and lower sideband frequency segments, while the B2 sideband is in a band just below the lower sideband frequencies, and the A2 band occupies a frequency section just above the normal upper sideband. Front panel controls allow each channel to be individually enabled or disabled while automatically compensating the transmitter gain to equally divide the available power among the enabled sidebands. To accommodate the extra sideband and audio cards, the HF-8014/14A is approximately 3.5 inches longer than the standard 2-channel HF-8010/10A exciter.

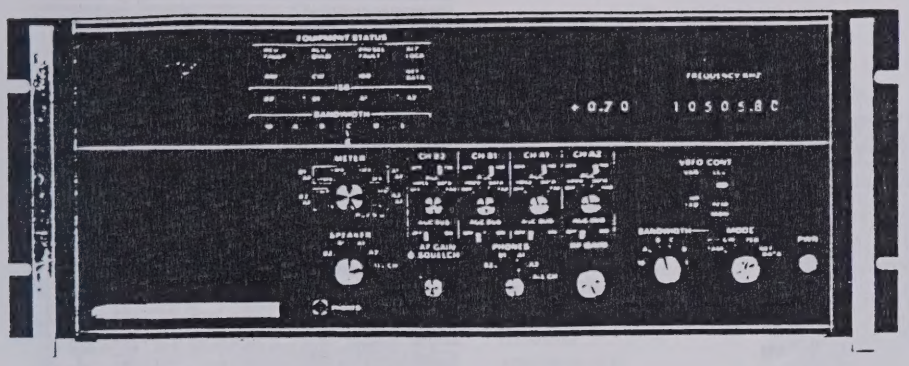
Several other enhancements are found in the HF-8014/14A. The audio signal for each channel is processed by a slow decay gain control circuit to compensate for differing line input levels. This line-leveling amplifier may be disabled by moving a strap on the audio card when the function is not desired. A new frequency standard switchover option, the AC-8015, can be used with the oven stabilized frequency option to guarantee a continuous accurate transmit frequency. Should the external frequency standard input fail, the switchover option will automatically connect the built-in oven standard to the exciter's frequency synthesizer. A continuous 100-kHz output is also provided by the AC-8015 for use by external peripheral equipment.

HF-8054/54A 4-Channel Receiver

The new ISB receiver and exciter filters are the crystal network type and have improved performance over that offered in the standard 2-channel HF-80 radio. The passband response is ±1.0 dB over a 2.85-kHz bandwidth (250 to 3100 Hz at audio), while the attenuation is greater than 60 dB, 500 Hz above and below either passband edge. Additionally, the differential delay is less than 500 μs across the 2.3-kHz bandwidth (600 to 2900 Hz at audio) as required when high-speed data modems, such as Collins TE-233 series, are used. In the future, Rockwell-Collins will offer 4-channel mechanical if filters with adequate performance and lower cost.

There is a versatile gain control selection for each ISB channel. Each channel has an independent automatic gain control (AGC) which may be set for fast, medium, or slow response times. A fast response is usually best for data signals, while medium or slow is better for voice signals. The AGC voltage, approximating the signal level, can be monitored at a terminal at the rear of the receiver. A voltage may also be applied to this terminal, with the AGC set to OFF, for external gain control of the channel. The gain difference between channels may be up to 30 dB in the independent mode. Two or more channels may be forced to have identical gains by switching their AGC to a common bus. In this manner, the channel with the strongest signal controls the gain of all the channels bused together. A channel with constant-level FSK signals could be used to limit the gain of a voice channel and to reduce noise where there is no voice signal.

A new mode, called NET DATA, is provided on the HF-8054/54A units. Only the A1 and B1 sidebands are enabled in this mode, and a special AGC discharge circuit is used to quickly switch from strong to weak receive signals.



HF-8054 Receiver

HF-8014/14A 4-Channel Exciter Characteristics

Physical

Size: 483 mm wide x 178 mm high x 574 mm deep (19 in w x 7 in h x 22.6 in d) including handles.

Weight: 21.8 kg (48 lb) maximum.

Environmental

Temperature: 0 to 50 °C operating; -57 to 71 °C nonoperating.

Relative humidity: 0 to 95%; without condensation, to 50 °C.

Altitude: 3,048 m (10,000 ft); 0 to 50 °C, operating. 4,572 m (15,000 ft); 0 to 25 °C, operating. 12,192 m (40,000 ft); -57 to 71 °C, nonoperating.

Electrical

Primary input power: 100, 115, 215, 230 V ac, ±10%, single phase, 47 to 420 Hz; maximum input power, 80 W.

Rf output level: 200-mW PEP minimum.

Rf output impedance: 50 Ω, nominal.

Frequency range: 1.6000 to 30.0000 MHz (100-Hz increments, standard; 10 or 1 Hz, optional).

Frequency tune time: 2 ms nominal, 5 ms maximum.

Frequency stability (standard): Better than 5 x 10^{-7}, 0 to 50 °C. Drift rate less than 3 x 10^{-8} per week.

Frequency stability (optional oven stabilization): Better than 1 x 10^{-8}, 0 to 50 °C. Drift rate less than 1 x 10^{-8} per week, after 72 hours continuous operation.

External frequency reference (optional): Accepts a facility reference input at 0.1, 1.0, or 5.0 MHz and 0.2 to 1.0 V rms into 50 Ω.

Emission modes: CW (A1), AME (A3H), ISB (A3B, A9B, A3J), pilot carrier (A3A), 4-channel ISB.

Channel bandwidth: 2.85 kHz (2-dB bandwidth, 250 to 3100 Hz at audio) in ISB mode.

Carrier suppression: ISB at least 55 dB; pilot carrier 20 ±1 dB (adjustable 13 to 23 dB) below transmitter PEP.

Line audio input (each of four inputs): Impedance 600 Ω ±5%, preset for -15- to 0-dBm input to provide full rated output. Adjustable for input levels of -26 to +10 dBm.

Microphone input: Front panel jack for low-impedance (200-Ω nominal) microphone. Nominal -55 dB for rated PEP output.

Power amplifier interface: Average power gain automatically set during tune cycle and peak power control during operation. Compatible with all HF-80 power amplifiers.

HF-8054/54A 4-Channel Receiver Characteristics

Physical

Size: 483 mm wide x 178 mm high x 574 mm deep (19 in w x 7 in h x 22.6 in d) including handles.

Weight: 21.8 kg (48 lb) maximum.

Environmental

Temperature: 0 to 50 °C, operating; -57 to 71 °C, nonoperating.

Relative humidity: 0 to 95%; without condensation, to 50 °C.

Altitude: 3,048 m (10,000 ft); 0 to 25 °C, operating. 4,572 m (15,000 ft); 0 to 25 °C, operating. 12,192 m (40,000 ft); -57 to 71 °C, nonoperating.

Electrical

Primary input power: 100, 115, 215, 230 V ac ±10%, 47 to 420 Hz; maximum input power is 80 W.

Modes of operation: AM (A3), CW (A1), ISB (A3B, A3J, A9B), 4-channel ISB.

Frequency coverage: 250 kHz to 29.999 MHz.

Frequency stability: Better than 5 x 10^{-7} over the operating temperature range. Drift rate not more than 3 x 10^{-8} per week.

Frequency stability (optional oven stabilization): Better than 1 x 10^{-8} temperature range and drift rate less than 1 x 10^{-8} per week maximum after 72 hours continuous operation.

Tune increments: 10 Hz, standard (1 Hz, optional, for processor-controlled receivers only).

Channeling speed: 2 ms nominal; 5 ms maximum.

Bandwidths:

AM or CW: -6 dB, 16 ±4 kHz, -50 dB, 100 kHz maximum.

ISB (four separate filters): -2 dB response, 250 Hz maximum, 3100 Hz minimum from carrier; -60 dB response, -250 Hz minimum, 3550 Hz maximum from carrier.

Optional filters: Up to five additional filters may be added by optional plug-in card.

Sensitivity: The table below gives the maximum rf input signals for a 10-dB (s+n)/n output ratio. ("Hard" refers to signal generator open circuit voltage, and "soft" is the signal generator voltage terminated into 50 Ω.)

Mode	Bandwidth	Frequency	RF Input
ISB	3 kHz	0.25 to 1.6 MHz	2 μV (hard) 1 μV (soft)
ISB	3 kHz	1.6 to 30 MHz	0.7 μV (hard) 0.35 μV (soft)
AM, CW	16 kHz	0.25 to 1.6 MHz	16.5 μV (hard) 8.3 μV (soft)
AM, CW	16 kHz	1.6 to 30 MHz	5.7 μV (hard) 2.85 μV (soft)

Antenna input impedance: 50 ohms, nominal.

Rf overload protection: Up to 100 V rf, power on or off. Automatic reset on removal of strong signal.

Audio outputs:

Line: Four independent outputs, each 600 Ω ±10%, balanced, 0 dBm nominal. Adjustable from -20 to +10 dBm.

Headphone: 600 Ω nominal; front panel volume adjustable to +10 dBm.

Speaker: 8 Ω nominal, 2 W peak.

Squelch: Operates on audio signal-to-noise ratio. Applicable only to speaker output.

Audio distortion: Total harmonic distortion for the line output is less than 1% for the ISB mode and less than 3% for the AM mode. Harmonic distortion for the speaker and headset output will be less than 5%.

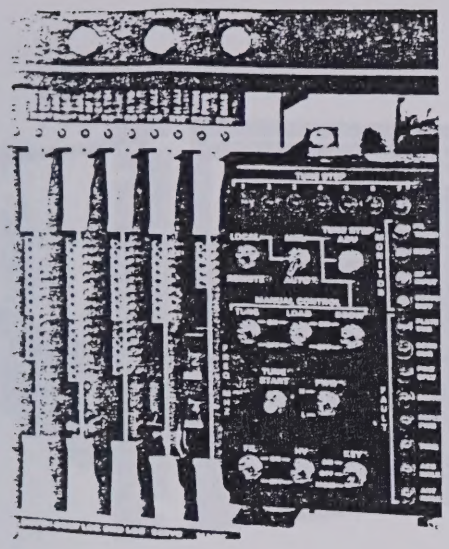
AGC control: Less than 4-dB audio increase for an rf signal increase from 3 μV to 0.3 V.

AGC time constants:

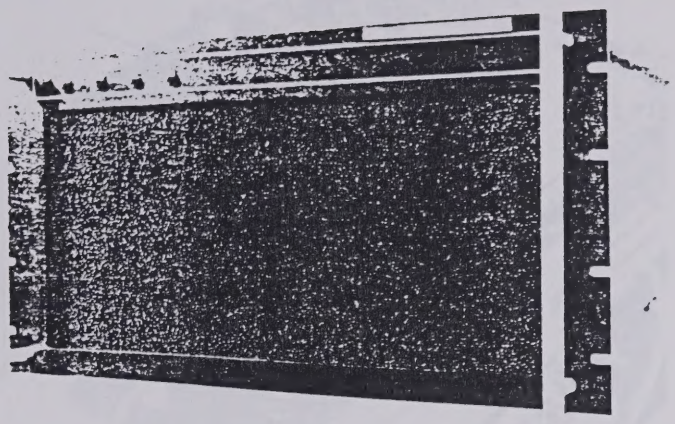
AGC Mode	Attack Time	Decay Time
Fast	20 ms max	15 to 30 ms
Med	20 ms max	70 to 150 ms
Slow	20 ms max	1 to 2 s

In-band intermodulation: At least 47 dB below either of two equal input tones of 100 mV per tone, separated at least 200 Hz.

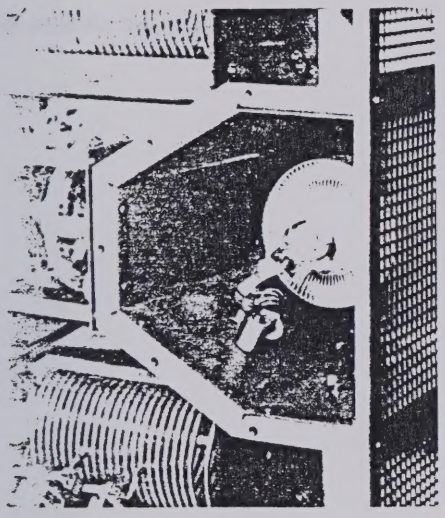
Out-of-band intermodulation: Second- and third-order products are at least 60 dB below two equal -15-dBm input tones which are 50 kHz or more off the tuned frequency.



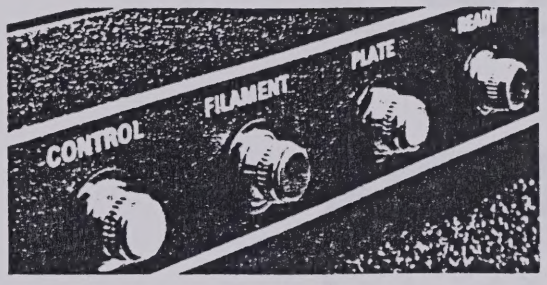
Test points and optional TS-8020 maintenance panel aid troubleshooting



HF-8020 1-kW Power Amplifier



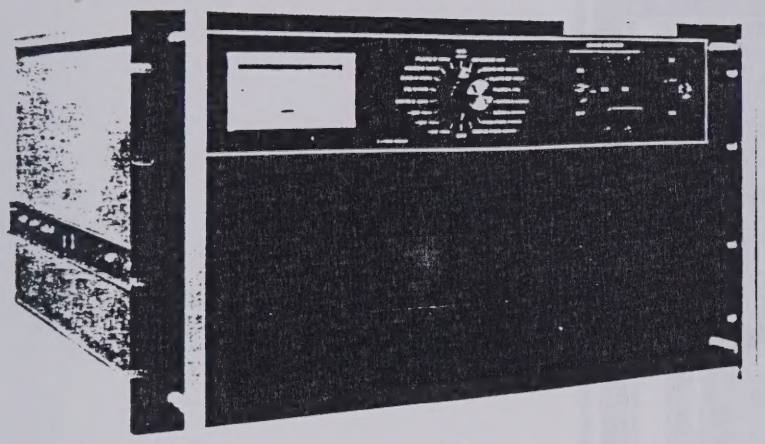
Single output tube improves performance and reliability



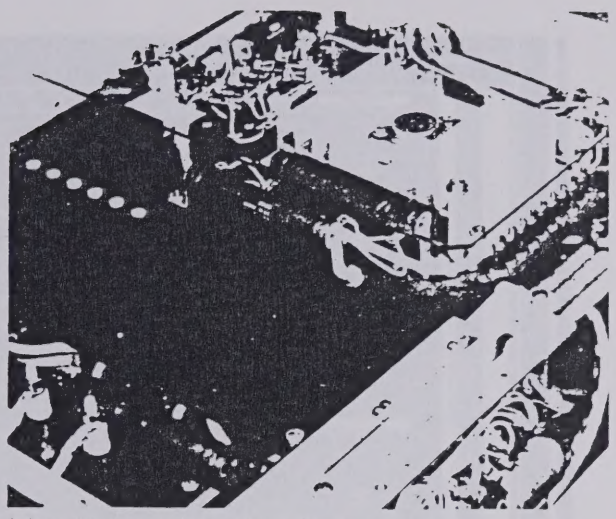
Status indicators aid operator

HF-8020
1 kw power amplifier

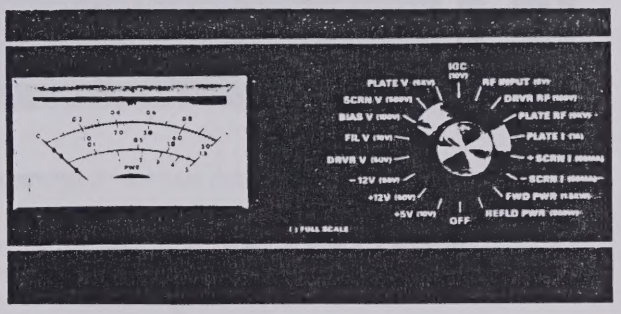
& HF-8030
pa power supply



HF-8030 PA Power Supply



Adequate test points aid troubleshooting



Power amplifier monitoring made easy

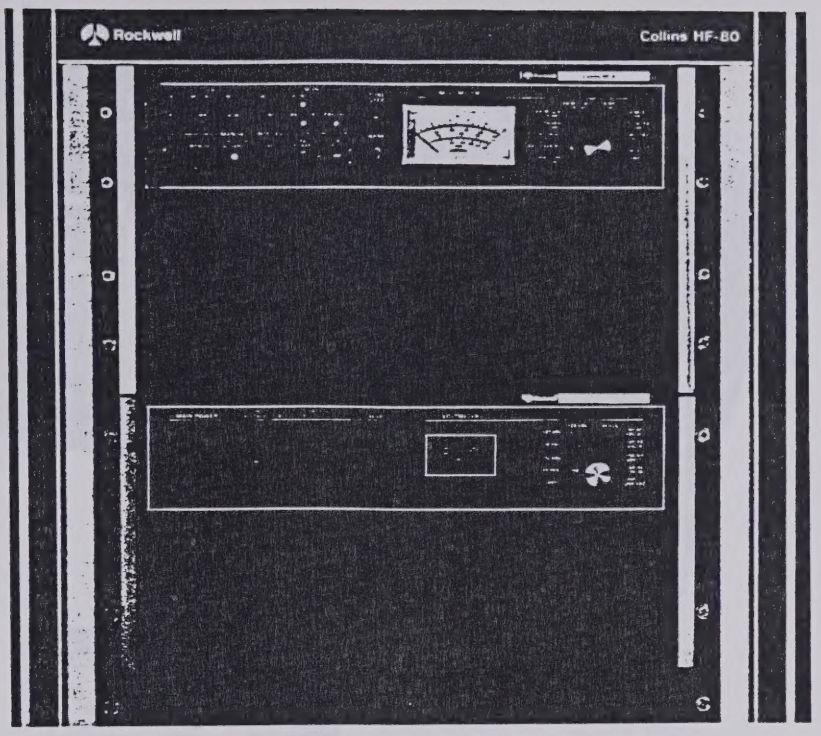
A Choice of Linear Power Amplifiers: From the 100-milliwatt output from the exciter, the HF-8020, HF-8021, or HF-8022 Power Amplifier will produce a conservatively rated 1-, 3-, or 10-kilowatt rf power output, pep or average. All that is needed to put any of the amplifiers into operation is primary power, an exciter, CW key or microphone, and an antenna with not more than 3:1 vswr. For installations requiring an antenna that present a greater than 3:1 vswr, an optional antenna coupler is available to match the 1 kW amplifier output to the antenna.

Output from the amplifiers can be on any frequency within the 2- to 30-MHz range (down to 1.6 MHz with the HF-8020) —and in 100-Hz, 10-Hz, or 1-Hz increments with the optional circuit cards installed in the exciter. The station may operate fixed-frequency, or periodically change frequencies—a 10-second maximum process with the power amplifier's automatic tuning feature.

The newly developed HF-8020 1-kW Linear Power Amplifier follows the same design-to-cost considerations as the rest of the HF-80 family. Except for the final output tube, the all-new design is completely solid state. Control circuits were engineered to match the exciter outputs, whether manually or processor controlled. The same reliability-derating practices have been applied to the rf stages as to the other system units followed. This ensures full rated rf output power throughout the usual component aging process, one of the reasons for Rockwell-Collins continuing tradition of excellence in the hf communications field.

The HF-8020 Power Amplifier and its associated HF-8030 Power Supply both fit in a standard EIA equipment rack. Built-in blowers provide cooling air. Plug-in circuit cards with easily accessible test points and spacious internal layout for easy access to parts reduce down time if repair becomes necessary.

A TS-8020 plug-in maintenance panel is available for the HF-8020 to assist in troubleshooting and checkout. This panel (shown in upper left photo on opposite page) permits the technician to take control of the power amplifier and step it through its tune cycle while go/no-go indications are displayed by LED's on the panel.



1 Kilowatt solid state transmitter in optional cabinet

HF-8023 1-kw power amplifier & HF-8031 power supply

Collins Telecommunications Products Division now offers a completely solid-state HF-80 1-kW power amplifier. This power amplifier, the HF-8023, will work with all the upcoming high-frequency communication techniques including frequency agile and wide bandwidth type transmissions. In addition, the price has been held low enough that customers can select this power amplifier over the HF-8020 when weight and efficiency are the important factors. In short, this is Rockwell-Collins first (marketed) all-solid-state PA that provides performance, reliability, maintainability, and costs commensurate with the well-established HF-8020 electron tube PA.

HF-8023 Power Amplifier

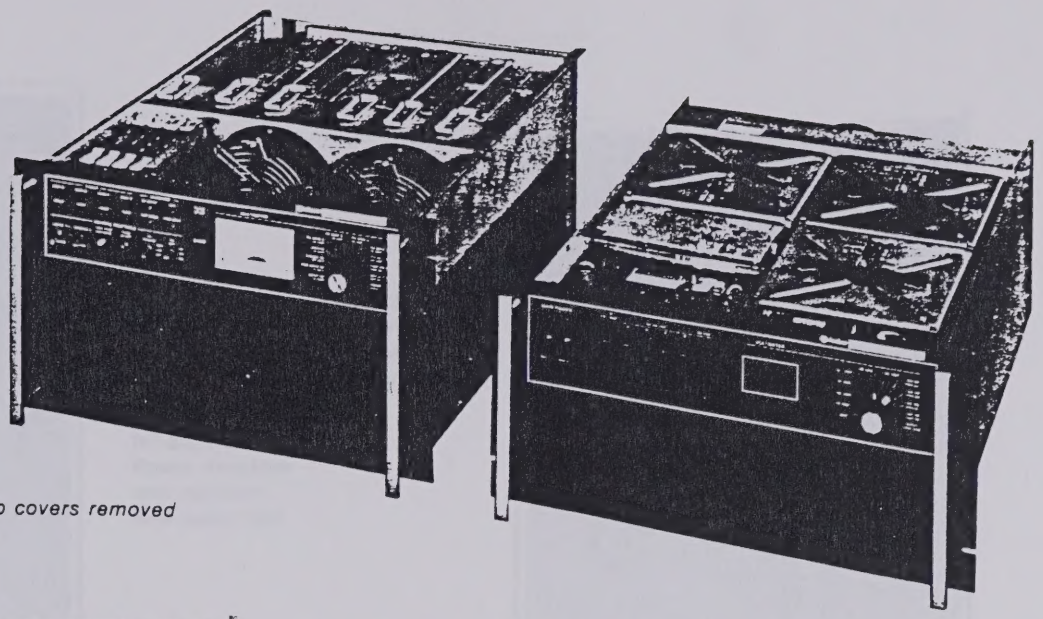
The basic construction of the HF-8023 emphasizes ease of maintenance. There is one driver module for four power modules whose outputs are combined for a total of 1000 watts. All five modules can be easily removed for service. The output is filtered for harmonic suppression, and the filter is also a replaceable module. On the front panel, there are complete monitoring facilities for faults and a panel meter to indicate the rf voltage and dc current at each module. In addition, the meter has positions to monitor forward power, reflected power, and vswr at the rf output. A local control mode allows the HF-8023 to be driven from a signal generator in place of the system exciter for testing. One unique feature of the HF-8023 is its automatic voltage selection for higher efficiency. Initially, the supply voltage is 50 V dc; but when the PA senses a consistent high average power, as would be found during an FSK transmission, the collector supply drops to 40 V dc to increase efficiency. This feature, in conjunction with other characteristics of the HF-8031 power supply, assures that less than 3000 watts is required from the facility power line for a 1000-watt rf output.

High reliability has also been designed into this new power amplifier. A fast-acting power control loop senses vswr and transistor dissipation to provide full protection of the final transistors. A unique, Collins-designed, transistor heat sink achieves extremely low thermal resistance for the output transistors. In the rare event that one module should fail, its output would be disabled and the power amplifier would continue to operate at reduced output levels. The service reliability is enhanced by the absence of high dc potentials and servo-tuned networks. The only moving rf contacts are found in relays which are always switched while the rf is off.

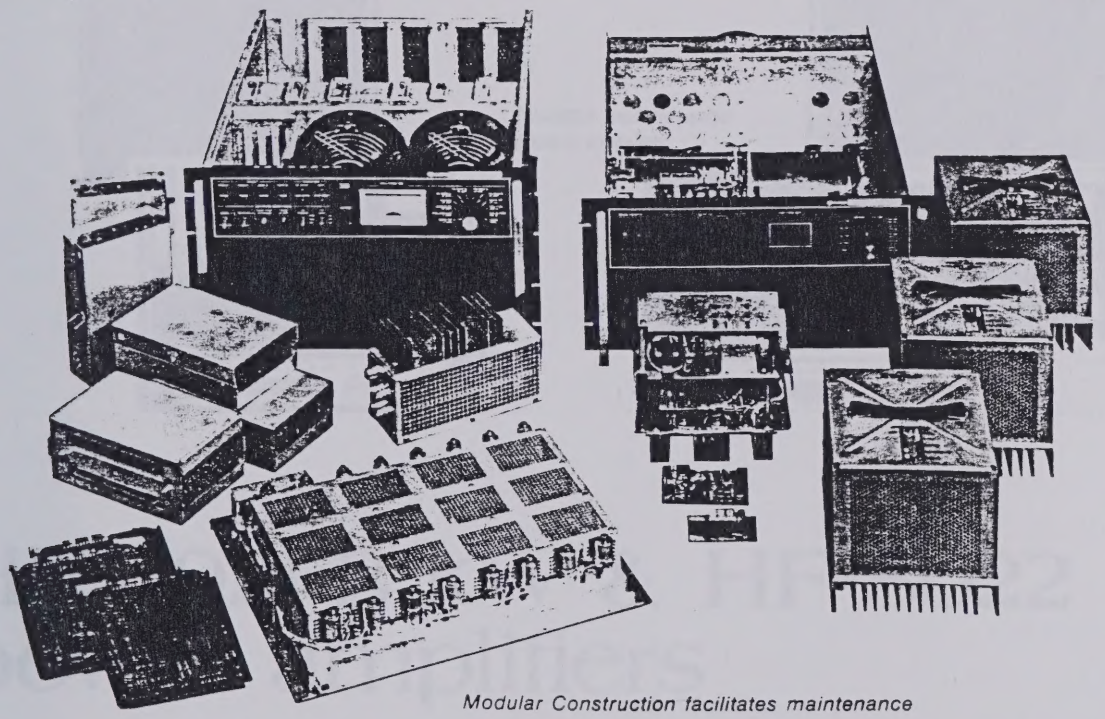
The HF-8023 is compatible with the HF-8010, HF-8014 Exciters, HF-8070 Receiver/Exciter, and HF-8040 Antenna Coupler.

HF-8031 Power Supply

Not all the technical advances are found within the new power amplifier. Consider, for example, the weight comparison of the HF-8030 Power Supply for the 1-kilowatt HF-8020 PA with that of the new HF-8031, both of which supply up to 2500 watts output. The HF-8030 weighs 160 pounds; yet the new HF-8031 weighs only 78 pounds. This dramatic 2-to-1 reduction in weight has been accomplished by use of "off-the-line, high-frequency switching regulators." As was done with the power amplifier, most of the components and circuitry are contained in four plug-in modules; two are used to supply power to the four PA output modules, one for the PA driver and one for all PA low-level bias voltages. All four PS modules can be quickly and easily replaced for maintenance and, in the event of failure of either PA power supply module, the power amplifier may continue to operate at reduced power-out levels. A digital panel meter provides instant monitoring of all output voltages, as well as the ac input power line.



HF-8023 and HF-8031 with top covers removed



Modular Construction facilitates maintenance

HF-8023/8031 Characteristics

Frequency range: 1.6 to 30.0 MHz.

Rf power output: 1000 W PEP or average (±0.5 dB).

Rf input power: 100 mW maximum for rated output.

Rf input impedance: 50 Ω nominal; 1.3:1 vswr maximum.

Rf load impedance: 50 Ω nominal; rated power into 1.3:1 vswr.

Intermodulation distortion: 30 dB or better below one of two equal tones at rated PEP output power.

Harmonic attenuation: 55 dB or better below fundamental frequency at rated output power into 50-Ω load.

Tuning time: 350 ms maximum.

Power requirements: 208, 220, 230, 240 V ac ±10%, 47 to 63 Hz single phase, 3000-W maximum input to power supply for 1-kW rf output.

Temperature range: -30 to +55 °C, operating; -62 to +70 °C storage, nonoperating.

Humidity: 0 to 95% relative humidity, nonoperating.

Altitude: 0 to 10,000 ft, operating.

Shock: 15 g MIL-STD-810C, method 516.2, procedure 1.

Vibration: MIL-STD-810C, curve AW, method 514.2, procedure X, except 1.5 g, 5.5 to 55 Hz.

Size:

HF-8023: 260 mm (10.25 in) high;
585 mm (23.05 in) deep;
483 mm (19 in) wide.

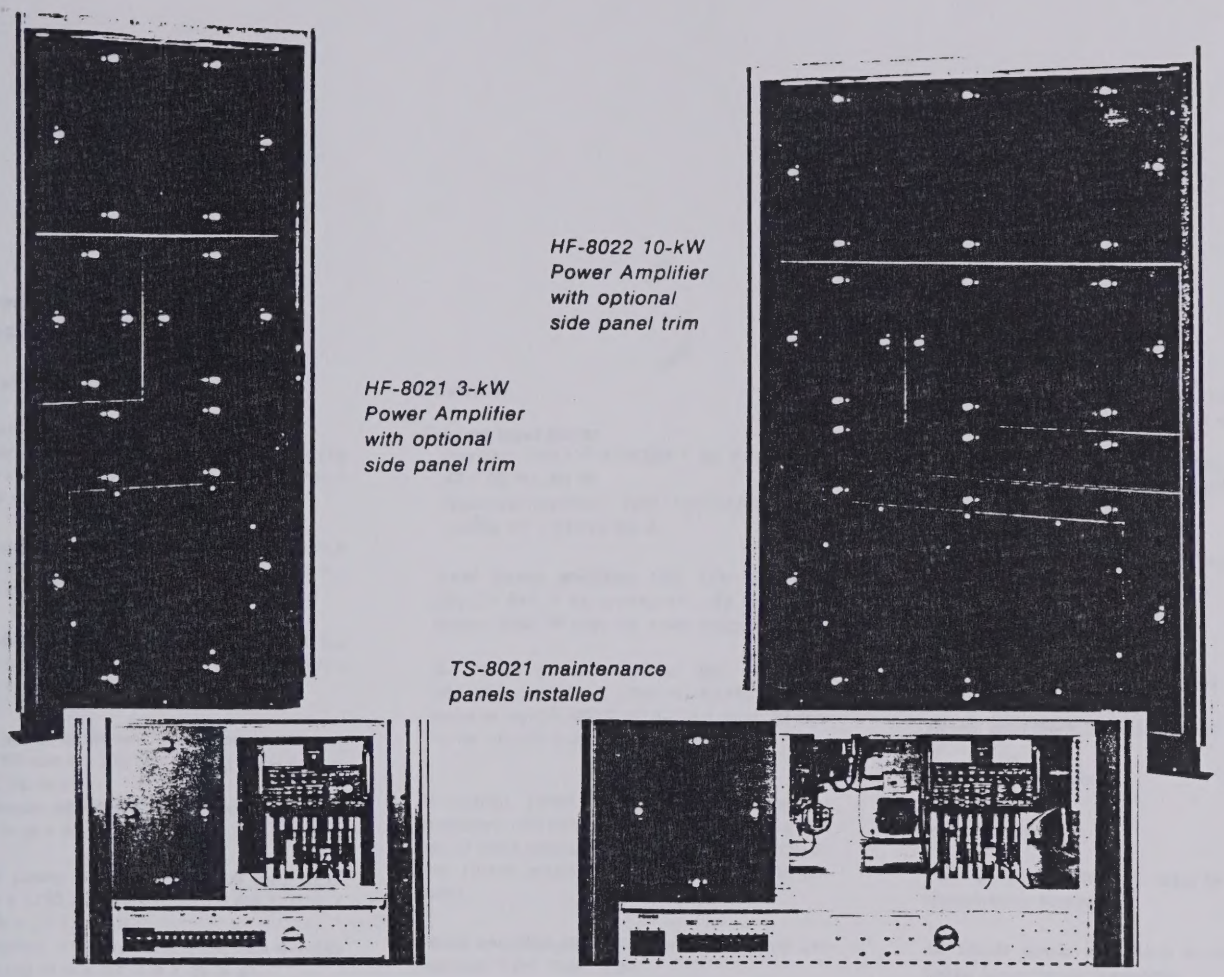
HF-8031: 222 mm (8.75 in) high;
601 mm (23.65 in) deep;
483 mm (19 in) wide.

Weight:

HF-8023: 23.6 kg (52 lb).

HF-8031: 35.4 kg (78 lb).

Total: 59.0 kg (130 lb).



HF-8022 10-kW Power Amplifier with optional side panel trim

HF-8021 3-kW Power Amplifier with optional side panel trim

TS-8021 maintenance panels installed

HF-8021 3 kw & HF-8022 10 kw power amplifiers

The HF-8021 and HF-8022 Power Amplifiers use the highly successful Collins 208U-3A and 208U-10A Power Amplifiers as a baseline and employ the design-to-cost approach in keeping with the HF-80 family. Simplified control circuits were designed for compatibility with the processor control features of the rest of the HF-80 system. Rf circuits were retained from the performance proven 208U-series design.

Power output levels of these HF-80 Power Amplifiers are 3 kW for the HF-8021 and 10 kW for the HF-8022. Each can deliver full rated output level even when operating into a vswr of up to 3 to 1.

Power supplies for all the amplifiers are designed to operate from a wide range of primary input power, making an almost universal supply capable of operation with any international primary voltage. Power supply circuits accommodate up to 5 percent variations around the selected voltage while still delivering rated rf output power from the amplifier. New rf circuit design in these power amplifiers reduce intermodulation distortion to 46 dB below rated envelope power and harmonics 80 dB below rated power.

A TS-8021 optional plug-in maintenance panel speeds up maintenance checks and troubleshooting. The panel gives the maintenance technician direct control of the amplifier and displays monitor signal outputs so that only an rf input from the exciter or signal generator is required during maintenance checks. Switches allow manual transmitter keying, enabling or inhibiting various control voltages, servo operations, and advancing the tune cycle operation one step at a time. Monitor signals aid rapid determination of fault location to major functional areas of the amplifier.

Transmitter and Transceiver Characteristics

Physical

Size (nominal)

Exciter and receiver/exciter: 483 mm w x 178 mm h x 531 mm d (w/handles) (19 in w x 7 in h x 20.9 in d).

1-kW power amplifier: 483 mm w x 267 mm h x 653 mm d (w/handles) (19 in w x 10.5 in h x 25.75 in d).

1-kW power supply: 483 mm w x 267 mm h x 636 mm d (w/handles) (19 in w x 10.5 in h x 25.06 in d).

3-kW power amplifier: With full trim: 808 mm w x 1753 mm h x 705 mm d (31.81 in w x 69 in h x 27.75 in d).
Untrimmed: 660 mm w x 1753 mm h x 635 mm d (26 in w x 69 in h x 25 in d).

10-kW power amplifier: With full trim: 1237 mm w x 1753 mm h x 705 mm d (48.72 in w x 69 in h x 27.75 in d).
Untrimmed: 1168 mm w x 1753 mm h x 635 mm d (46 in w x 69 in h x 25 in d).

Weight (nominal)

Exciter: 19 kg (42 lb).

Receiver/exciter: 19 kg (42 lb).

1-kW power amplifier: 23.6 kg (52 lb).

1-kW power supply: 71.6 kg (158 lb).

3-kW power amplifier: With full trim: 499 kg (1100 lb).
Untrimmed: 429 kg (945 lb).

10-kW power amplifier: With full trim: 849 kg (1870 lb).
Untrimmed: 754 kg (1660 lb).

Environmental

Temperature: 0 to +50 °C (+32 to +122 °F), full performance: -20 to 0 °C (-4 to +32 °F), reduced performance: -57 to +70 °C (-71 to +158 °F), nonoperating.

Relative humidity: 0 to 95 percent at 30 °C (86 °F).

Altitude: All: 3,048 m (10,000 ft) at +50 °C (+131 °F).

All: 4,572 m (15,000 ft) at +25 °C (+77 °F).
All: 12,192 m (40,000 ft), nonoperating.

Electrical

Primary input power

Exciter: 100/115/215/230 V ac ±10%, 47 - 63 Hz; 80 W.

Receiver/exciter: 100/115/215/230 V ac ±10%, 47 - 63 Hz; 95 W.

1-kW power amplifier: 105, 115, 122, 210, 230, or 244 V ac ±10%; 47 - 63 Hz; single phase; 3500 W max for 1-kW output.

3-, 10-kW power amplifier: 208, 225, 243, 360, 390, or 422 V ac ±5%; 47 - 63 Hz; 3-phase delta or wye; 9100 W for 3-kW output; 23,000 W for 10-kW output.

Rf output (from exciter; input for power amplifier): 100 mW pep or average for rated output; (2 watts average input power accepted by 3- and 10-kW amplifiers without damage to circuits).

Power amplifier input impedance: 50 ohms, unbalanced; 1.3:1 vswr, max.

Rf output (from power amplifiers): Into 50 ohms, 3:1 vswr maximum load.

1-kW: High power: 1 kW, +0.5, -1.0 dB, pep or average.
Low power: 300 to 700 W, adjustable.

3-kW: High power: 3 kW, +0.5, -1.0 dB, pep or average.
Low power: 700 to 2000 W, adjustable.

10-kW: High power: 10 kW, +0.5, -1.0 dB, pep or average.
Low power: 3 to 7 kW, adjustable.

Frequency range

Exciter: 1.6000 to 30 MHz (100-, 10-, or 1-Hz tuning increments, depending on options).

1-kW power amplifier: 1.6 to 30 MHz.

3-, 10-kW power amplifiers: 2 to 30 MHz.

Frequency stability: Not less than 5×10^{-7} over specified temperature range; drift rate of not more than 3×10^{-8} per week.

Optional oven standard provides not less than 1×10^{-8} over specified temperature.

External standard option provides stability of the 100-kHz, 1-MHz, or 5-MHz external standard used.

Exciter bandwidth: 250 Hz, max, from carrier; 3000 Hz, min, to -4-dB points, SSB modes.

Modes of operation: A3B/A9B (ISB), A3J (USB or LSB), A3H (AME), A1 (CW), A3A (pilot carrier), standard. F3 (FM) optional.

PA bandwidth: 12-kHz, 0.1-dB max variation over a 3-kHz segment.

Frequency tune time

Exciter: 2 ms nominal, 5 ms max.

Power amplifiers: 5 s nominal, 10 s max.

Duty cycle: Continuous.

Harmonic output

1-kW power amplifier: At least 54 dB below fundamental frequency.

3-, 10-kW power amplifiers: At least 80 dB below fundamental frequency.

Intermodulation distortion

1-kW: 41 dB below pep of two equal tones at rated output.

3-, 10-kW: 46 dB below pep of two equal tones at rated output.

Rf protective circuits: Internal gain control: Protects amplifier from damage due to overdriving or abnormal tuning.
Reflected power: Unkeys amplifier when reflected power is greater than 3:1 vswr at full output power.
Antenna interlock: Prevents amplifier keying if an rf load is not present.

Audio circuits (both channels when in ISB) line: Input: 600 ohms ±10%, balanced; 0 dBm, nominal, for full rated output; adjustable between -20 and +10 dBm.
Output: 600 ohms ±10%, balanced; 0 dBm, nominal; adjustable between -20 and +10 dBm.

Microphone: Dynamic type: 200 ohms ±10%, unbalanced; -55 dBm, nominal, for rated output from power amplifier.

Specifications subject to change without notice